CRITICAL CRITERIA ON BASIN-RANGE STRUCTURE

As commonly regarded, basin-range mountains constitute an orogenic type by themselves; novel, isostatic, youthful appearing. The hypothesis of their structure is one of the most brilliant concepts in the history of American geology; at the same time it is one of the most fanciful, as the severe testing of a generation amply proves. Singularly enough, the theory had its birth in a district where even its fundamental form seems to be entirely without representation.

At this day and distance the extension of the hypothesis to all the so-called fault-block mountains of the arid regions appears to be not only too broad a generalization, but quite unfortunate. Although I should not wish to be the first to make so sweeping an assertion as lately was done by Dr. Spurr, that no one has ever seen the fault-lines blocking out the desert ranges, his statement is almost literally true, as all recent critical evidence on the subject fully attests.

The attractive feature of Gilbert's theory of basin-range structure was of course the strong support it was thought to give to the now famous hypothesis of isostasy. Concerning some of the fundamental premises, I long ago entertained serious doubts. It has since been fully shown that there was decided error in determining the degree of completeness of the compensation that invalidated the conclusions.

With the challenge of the basin-range hypothesis there has come a demand for citations of concrete examples in support of the theory. Thus far, after the elapse of a full decade and after frequent repetition of the demand, the evidence has not been forthcoming. The Cricket Range, in Utah, recently described in this journal as furnishing a key to the problem, emphasizes this shortcoming. It is not the mere display of profound faulting that is the main desideratum. Abundant evidence of this kind is readily found in nearly every one of the desert ranges. In the majority of cases such faultings are found to have no relations to the present orogeny. Where, according to the hypothesis, the bordering faults should be they are not; but when found they are usually miles out on the intermont plains. The present sharp meeting of mountain and plain is now explained by causes other than dislocation, through ordinary stream-corrasion according to Paige, or through sheet-flood erosion as urged by McGee. Under a title of "Locus of Maximum Lateral Deflation in Desert Ranges" I have called attention to its eolative origin.

By displacement are explained the steep truncations of the transverse ridges of many desert ranges. That these bevelments are really fault-planes bounding the mountain-blocks will have to be more strongly supported than it is now, by direct and unquestionable evidence, before the assertion can be accepted. These rows of truncated ridges seem rather to mark the lines of battle between the plano-rasive advance of eolic degradation from the desert side and the normal stream-corrasion of the more moist mountain areas.

In the light of the recent advances in our knowledge of the prodigious amount of deflation which takes place under climatic conditions of aridity it appears that the generally accepted hypothesis of basin-range structure will have to be abandoned and the origin of the desert mountains ascribed to eolic erosion mainly, rather than to local tectonic displacement.

Charles R. Keyes

NOTE REGARDING THE RELATION OF AGE TO FECUNDITY [1]

In his valuable book on "The Physiology of Reproduction" Marshall,[2] in a section on the relation of age to fecundity, says (p. 590):

> The fecundity of the average individual woman may be described, therefore, as forming a wave, which, starting from sterility, rises somewhat rapidly to its highest point, and then gradually falls again to sterility. There can be no doubt that animals as a general rule tend to follow a similar law.

[1] Papers from the Biological Laboratory of the Maine Agricultural Experiment Station, No. 43.

[2] Marshall, F. H. A., "The Physiology of Reproduction," London (Longmans, Green & Co.), 1910, pp. xvii + 706.

A record of the entire breeding history of a rather remarkable ewe, of which I made a note some time ago for another purpose, illustrates this law in so clear a manner that it seems desirable to publish it with some discussion, particularly since the place of original appearance of the record is neither readily accessible nor likely to come to the attention of the biologist.

The record referred to was contributed to the *New England Farmer*[3] by Mr. Chas. Mattoon, of Lenox, Mass. The ewe in question was owned by one of his neighbors, Colonel Nathan Barrett, who, at the request of Mattoon, drew up the following account:

I hereby certify that I have owned a native ewe sheep, for the space of nineteen years, lacking a few days; having retained her usual vigor for seventeen years. But in the fall of 1822, I observed for the first time, and with no small degree of interest, that she slackened her pace, and went in the rear instead of front, which she continued to do for one year. After which, having nearly lost use of her eyes, and teeth, I took her under my immediate care for the last six months, until March, 1824, when she died with old age—having given me nineteen fleeces of wool, and borne me thirty-six full-grown lambs, viz.:

	Lambs		Lambs
April , 1806	1	1815	2
1807	1	1816	2
1808	2	1817	2
Apr. 3, 1809	3	1818	2
Mar. 29, 1810	3	1819	2
Making 6 lambs in 11		1820	2
months and 26 days.		1821	1
1811	3	1822	1
1812	3	1823	0
1813	3	1824	0
1814	3	Total	36

The general accord of this case with the law discussed by Marshall is obvious. Beginning with the minimum degree of fecundity possible (excluding absolute sterility) there is a rather rapid increase to a maximum, which is maintained for a time. This is followed by a decline in fecundity more gradual than the rise, ending finally in absolute sterility.

[3] Vol. III., June 3, 1825, p. 353.

The case is of especial interest in the present connection because of the fact that it is a *completed* record, carried to the natural end of life of the individual. Such completed breeding records are rare for higher animals.

It is of interest to make certain biometric computations from these data. If the age of the ewe is taken as abscissa and the number of lambs born as ordinate one can calculate by the ordinary methods the arithmetic mean point of this animal's total fecundity period, and certain other constants of interest. The only difficulty in making such calculations arises from the fact that no precise statement is made as to the age of the ewe at the time when the published lambing record begins. It is altogether reasonable to assume, however, that (*a*) the first lamb recorded is the first one borne by this ewe, and (*b*) that she was about one year old when this lamb was born. These assumptions will be made in the calculating, and further it will be assumed that the abscissal classes throughout center at even years of life.

Making these assumptions I find:

(*a*) That the arithmetic mean point of this ewe's effective breeding life was at 8.57 years.

(*b*) That the median point in her breeding career was at 8.17 years. That is, she produced one half of her offspring before that age and one half after it.

(*c*) That the modal breeding point[4] (*i. e.*, the point of maximum fecundity per unit of time) was at 7.34 years.

Taking into account the 17 years in which some young were born I find the following constants regarding the number of lambs per birth:

Mean number of lambs per birth	2.12 lambs.
Standard deviation in number of lambs per birth	.76 lambs.
Coefficient of variation in number of lambs per birth	35.78 per cent.

These are intra-individual constants based on an unusually long and completed breeding

[4] Calculated by the approximate relation that the distance from mean to mode is three times the distance from mean to median.

history. For comparison the following intraracial (inter-individual) coefficients of variation for fecundity in other forms are tabled:

Constants of Variation in Fertility and Fecundity in Various Animals

Organism	Character	Coefficient of Variation	Authority
Poland-China swine.	Size of litter	27.411	Surface[5]
Duroc-Jersey swine.	Size of litter	25.997	Surface[5]
Mouse	Size of litter	37.5	Weldon[6]
Horse	Fecundity[7]	24.771	Pearson[8]
Man	Number of children	48.41	Powys[9]
Domestic fowl	Annual egg production	34.21	Pearl and Surface[10]

It is plain that the individual variability in "size of litter" shown by this ewe is of the same general order of magnitude as that found in other organisms for fecundity characters.

Raymond Pearl

The Induction of Nonastringency in Persimmons at Supranormal Pressures of Carbon Dioxide

In a previous issue of this periodical,[1] I reported the results of some experiments to determine the relation of different pressures of carbon dioxide to the rate at which persimmons are rendered non-astringent by means of that gas. Two varieties were used in those experiments, *Taber 129* and *Hyakume,* as these are understood at the Alabama Experiment Station. I had already found that under normal pressure of pure and of approximately pure carbon dioxide[2] these varieties occupied from six to eight days in losing astringency, the *Hyakume* being the slower to respond to treatment. Under a pressure of 15 pounds of pure carbon dioxide, the period was found to be reduced to less than 46 hours. To be more explicit, 24 hours was found to be insufficient for either variety, while at the end of 46 hours all astringency had totally disappeared. The minimum period required at this pressure was not determined at the time for lack of material. It was, however, quite evident that the time necessary to render these varieties non-astringent at normal pressure of carbon dioxide can be reduced to less than one fourth at 15 pounds. It then remained until the season just closed to determine these relations more accurately and with reference also to still higher pressures. It is upon this work that I desire to submit at this time a preliminary report.

Meanwhile the results of experiments made by Dr. H. C. Gore[3] on the effect of carbon dioxide at normal pressure have appeared. The varieties which he studied include *Taber 23* and *Hyakume,* so that his results are distinctly pertinent in the present connection. Gore used a metal receiver especially designed by him to meet practical requirements, and, as indicated by his controls, is doubtless as efficient for exact experimentation as a glass receiver. The experiments with *Hyakume* were done at Macclenny, Fla., so that the fruits of this variety were not subject to the exigencies of transportation. As to these conditions, therefore, Gore's experiments may be regarded as directly comparable to my own, which also were done on the ground in metal glass and wooden receivers. Gore's *Taber 23* fruits were processed in Washington. As to the numbers of fruits used in Gore's experiments, only three of *Hyakume* were available,

[5] *Biometrika,* Vol. VI., pp. 433–436, 1909.

[6] *Biometrika,* Vol. V., pp. 442, 1907.

[7] Fecundity in this case means the fraction which the actual number of offspring arising from a given number of coverings is of the possible number of offspring under the circumstances.

[8] *Biometrika,* Vol. I., pp. 289–292, 1902. Actually only the moments of this fecundity curve are given at the place cited. From the moments we have calculated the coefficient of variation.

[9] *Biometrika,* Vol. V., p. 251, 1905.

[10] U. S. Dept. Agr., Bur. Anim. Ind., Bull. 110, Part I., pp. 1–80, 1909.

[1] Lloyd, F. E., "Carbon Dioxide at High Pressure and the Artificial Ripening of Persimmons," Science, N. S., 34: 924–928, December 29, 1911.

[2] The protocols of these and the remaining experiments will be published elsewhere in full.

[3] Gore, H. C., "Large Scale Experiments on the Processing of Japanese Persimmons, with notes on The Preparation of Dried Persimmons," U. S. Dept. of Agri., Bur. Chem., Bull. 155, May 10, 1912.